

Appendix D

Quantifying CHP Benefits

The following is a recommended procedure for district staff to include the benefits of combined heat and power (CHP) toward compliance with the emission level of central station power plants equipped with BACT. This credit cannot be used to avoid satisfying district BACT requirements or in quantifying an emission offset credit.

The credit for CHP is given to those installations that meet the following criteria: 1) design to achieve a minimum efficiency of 60% in the conversion of the energy in the fossil fuel to electricity and process heat; 2) design to achieve an annual average efficiency of 75% in the conversion of the energy in the fossil fuel to electricity and process heat; and 3) BACT requirements are satisfied for the size and class of electrical generation technology. In addition, efficiency determinations do not include time periods for startup, shutdown, and when the facility is not operated.

If all the above qualifications are satisfied, credit should be granted in form of allowing the process heat be added to the total energy production at the facility at the rate of 1 MWh for each 3.4 million Btu of process heat.

$$\text{Lb/MW-hr} = \text{emissions (lb/hr)} / [\text{MW (electrical)} + \text{MW (process heat)}]$$

EXAMPLE

Project with fuel input of 16 MW provides 5 MW of electrical output and an equivalent process heat requirement of 7 MW. The process heat requirement can dip to 5 MW. Emissions are at 5 ppmv at 15% O₂ or 0.25 lb/MW-hr.

Minimum overall efficiency:	62%
Average overall efficiency:	75%
Lb/MW-hr:	0.25
Lb/MW-hr with CHP credit:	0.1

Suggested Additional Permit Application Information for CHP final compliance credit

Quantifying fuel use:

- For a gas turbine based systems, include separately the average fuel use expected for the gas turbine, and if applicable, the average fuel use expected for using duct burners. Provide information on a daily and annual basis.
- For a reciprocating engine, provide brake specific fuel consumption and the average capacity the engine will operate at. Provide information on a daily and annual basis.

Quantifying electrical energy use

- Estimate average electricity production. If maximum capacity is cited for electrical production, documentation should be provided (for example, a contract with an utility). This value will be convert to Btu/hr based upon Btu in one kilowatt hour—3,414. Power output is expected output at generator terminals.

Quantifying process heat requirements

- Description of process heat requirements and variation of the process heat requirements over a year. Description should identify processes or equipment using the thermal energy and the amounts of process heat needed (in terms of million Btu/hour). At a minimum, provide minimum, maximum and annual average values.
- information on process heat delivered:

For each process heat stream, provide the inlet and outlet temperatures for the heat exchanger or heat recovery generator. For example, for an engine where process heat is taken from both the water jacket and the exhaust gases, this information should be provided for the heat extracted and used from the water jacket and the exhaust gases.

Process heat credit will be based upon the heat used by a process. Any energy associated with steam being condensed in a condenser is not counted toward the process heat of the CHP calculation.

Overall Minimum Efficiency Determination

For process heat requirements, the minimum process heat requirements (Btu/hr) should be used. The minimum process heat requirement does not include thermal energy from supplemental fuel firing.

For electricity generation, use the average electrical generation (convert to Btu/hr).

For fuel input (Btu/hr), do not include supplemental fuel firing.

Minimum efficiency = [electricity production + process heat]/[fuel energy input]

Overall Annual Average Efficiency Determination

For process heat requirements, use the total process heat requirement (Btu/hr). Supplemental fuel firing should be included.

For electricity generation, use the total electrical generation (convert to Btu/hr).

For fuel input, supplemental fuel firing should be included.

Minimum efficiency = [electricity production + process heat]/[fuel energy input]